МОВОЗНАВСТВО. ЛІТЕРАТУРОЗНАВСТВО

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INTONATION CLUES IN SPEECH PERCEPTION
(EXPERIMANTAL PHONETIC RESEARCH INTO ENGLISH DISCOURSE)

The article is devoted to a burning issue of contemporary phonetic experiments in the paradigm of cognitive science, namely the study into peculiarities of acoustic clues that enable perception and decoding of sound information. The article offers the systematization of different theoretical grounds that lay scientific foundation to research speech perception and generation in the view of cognitive operations ensuring the processes in focus. This systematization is carried out against the synergy of the assays contributed by different tracks of contemporary linguistic studies. The scientific approaches targeted at the analysis of speech perception are classified on the basis of practical objectives being solved in the course of each research. The article reports on the assays of experimental phonetic experiment aimed at defining the intonational clues ensuring the perception of speech. A range of segmental and suprasegmental units are analyzed in the light that the latter are viewed as constitutional entities of speech generation and perception. The focus is laid on the cognitive operations that are fundamental for speech processing and producing. The theoretical fundamentals of the phonetic experiment into peculiarities of speech perception are defined in the work. Relying on the results of the experiment the intonation group is approached as a basic construction unit as well as the main perceptional clue that embrace a cultural and linguistic expertise of the speaker. The intonation unit is interpreted through interrelation of its basic structural components that function as one unity and enable the speaker realize and comprehend lexical, grammatical and modal meaning of the utterance plunged in a situational context. In compliance with the results of the experiment, the article describes the functional value of the selected intonation clues that are critical for the speaker and listener to percept the message of the utterance.

Key words: *perception, intonation clues, intonation group, cognitive operations, sound information.*

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ІНТОНАЦІЙНІ КЛЮЧІ СПРИЙНЯТТЯ МОВЛЕННЯ
(ЕКСПЕРИМЕТАЛЬНО-ФОНЕТИЧНЕ ДОСЛІДЖЕННЯ
АНГЛІЙСЬКОГО ДИСКУРСУ)

Стаття присвячена актуальному питанню сучасних фонетичних досліджень у руслі когнітивного напряму – аналізу акустичних ключів, що уможливлюють декодування звукової інформації. У статті систематизовано різні загально-теоретичні засади дослідження процесів сприйняття та породження мовлення на тлі синергії різних напрямів сучасних лінгвістичних досліджень. Зазначені підходи до дослідження процесу сприйняття звукового повідомлення класифіковано з огляду практичних завдань, що вирішуються у межах різних наукових підходів до проблеми, що розглядається. Робота має на меті викласти результати експериментального фонетичного дослідження спрямованого на виокремлення інтонаційних параметрів сприйняття звукового повідомлення. У статті аналізуються різні сегментні та надсегментні одиниці мови, що є структурними елементами у процесі породження та сприйняття мовлення. Увагу зосереджено на когнітивних операціях, які відіграють вирішальну роль у сприйнятті звукової інформації мовцем, її декодуванні та подальшому кодуванні. Стаття містить опис методологічних засад дослідження сприйняття мовлення. Обґрунтовується доцільність розгляду інтонаційної групи як структурної бази породження та сприйняття мовлення. За результатами експерименту

запропоновано підхід до інтонаційної групи як звукової репрезентації над-сегментного рівня мови, що відобра-жає мовленнєвий та культурний досвід мовця, а також складається з певних просодичних елементів, які у сукуп-ності допомагають слухачеві зрозуміти лексичних, граматичний та модальний зміст повідомлення. У статті наведена низка інтонаційних одиниць, які у ході експерименту було виявлено значущими для сприйняття звукової інформації. Зокрема, описані функціональні особливості кожного з встановлених інтонаційних клячів з урахуван-ням їх ролі у сприйнятті та інтерпретації повідомлення мовцем.

Ключові слова: сприйняття, інтонаційні параметри, інтонаційна група, когнітивні операції, звукова інфор-мація.

Introduction. Perception of speech is a complex process that can be researched through insight into its cognitive mechanisms. This approach is ensured by the synergy of experimental data and methods from various sciences: physiology, cognitive science, linguistics, psychology and psychology. Perception is physiologically represented by a complex functional system, which is based on a dynamic sequence of links located at different levels of the nervous system. Meaningful perception, being a mental function of this physiological substrate, is also characterized by a level structure – both the stepwise nature of the process itself and the leveled hierarchy of speech signal processing (Vygotsky, 1962: 10–75).

In the framework of cognitive paradigm perception is, first of all, a physiological process that consists of mechanisms that, on the one hand, ensure the perception of speech, and, on the other hand, its generation. So, this analytical-synthetic process consists of two stages that enable the synthesis and analysis of sound information. At the first stage, auditory analyzers are activated, which isolate certain characteristic features in the sound message and combine them into complex deep representations. At the second stage, these deep structures are analyzed thanks to cognitive operations and correlated with certain contents, which are elements of the speaker's world picture (Krasovska, 2009: 15–20). Thus, the key objective of cognitive approach is to research into mental mechanisms that ensure realization of this multi-layer process and find out linguistic units which code and decode information flow.

As a result of multiple «distinctive» operations, an acoustic information is decoded in the mind and the meaning is extracted relying on «perceptional» clues formed on segmental and suprasegmental layers of the language. It should be noted that this approach resonates with F. de Saussure's statement that «only the acoustic impression has value» (Saussure, 2011: 11). According to the scientist, only the synergy of the methods of various sciences makes it possible to penetrate into the essence of the material phenomena of speech (Saussure, 2011: 11–13). This idea is confirmed by the modern turn of linguistic research towards experiments involving the methods of psycholinguistics and cognitive psycholinguistics,

which change the scientists' perception of the elements of speech and their interaction during the generation and perception of a message. Therefore, the **objective of this article** is to define intonation units that take part in processing acoustic information and transcoding it into meaningful language structures.

Topicality. Analysis of perception is impossible without acknowledgement that emotion is a part of the linguistic context, which is reflected in behavioral traits, mannerisms, attitude towards others, facial expression, and in language expression, intonation in particular (Izard, 1977; Shibles, 1974) At the same time, the study of the communicative functions of intonation proves that suprasegmental units mark a significant number of non-propositional content categories in speech, namely: logical-communicative blocks of statements (rhema/theme, mode/dictum, juxtaposition/contrast); modality, connotation, rhetorical instructions, expressive and iconic meanings (Bolinger, 1989; Ladd, 2001; Laver, 1994). Perception of acoustic information is approached differently. There are different models of perception that rely on a comparatively different range of principles. However, we believe that they can be classified into three major groups, focusing on:

– cognitive operations involved in the process of perception and generation of an utterance (Chomsky, 2002);

– type of information enabling a relevant coding and decoding of an acoustic information (Bahmut, 1991; Krasovska, 2009; Laver, 1994);

– contextual parameters defining the process of perception (Chafe, 1994; Cohen, 1967).

In the framework of the first approach the sound pattern of an utterance perceived by speaker is considered as a part of a complete formal model that involves transformation of surface structure of a sentence into its deep structure via cognitive operations aimed at deducting the meaning. Thus, speaker can understand the sense of structurally different sentences, such as:

(1) Mr. Smith ordered the coffee.

(2) The coffee was ordered by Mr. Smith.

(3) It was the coffee that Mr. Smith ordered.

In accordance with experimental data speakers extract a meaningful information relying on men-

tal operations based on such an algorithm: A→B / X→Y, where A identifies the unit subject to the rule; B indicates what form this unit should take; X and Y denote the contexts for A, located on the left and right. Generally, the rules are formulated in terms of feature matrices, not segments, and therefore affect any class element characterized by that feature (Chomsky, 2002: 30–45).

A somewhat different perspective is applied to research into perception within the approach developed by W. Chafe. Thus, consciousness is believed to focus on some important stretches of information in a given context that activates mental operation of its perception and decoding. Acoustic information is sifted by consciousness as a three-dimension body that contains such plans as: new-active-given. These information plans are reflected differently in the structure of the language. For example, given spans of information are realized in the form of weakly stressed pronouns and functional words, while active ones are strongly accented notional words. From this view point, oral discourse is generated not as a smooth stream, but in spurts, quanta. These quanta, most often commensurate in volume with one predication, are called intonation units (IU). Each IU reflects the current focus of consciousness, and pauses or other prosodic boundaries between IUs correspond to transitions of the speaker's consciousness from one focus to another. The average length of IU for the English language is 4 words. A prototypical IU coinciding with the clause thus verbalizes an event or state (Chafe, 1994).

The third approach is grounded on the assumption that speech perception embraces insight into audible elements of language, establish their relationship and formulate an idea of their meaning. Perception, therefore, unfolds on two levels – perception and comprehension. In its turn, comprehension involves decoding the general meaning that lies behind the directly perceived speech flow: the process of transforming what is perceived into the underlying meaning (Cohen, 1967: 177–192).

For instance, the meaning of the utterances *Cold! Hot!* can be perceived differently in compliance with a situational context. It can be interpreted as a piece of advice to get dressed warmly will dress warmer, a request to close a window or a guidance in a game. And in all cases, these utterances are a predicate to reality, to different situations. Following this logic, in the course of perception the recipient establishes semantic connections between words that make up the semantic content of the given utterance. As a result of comprehension, the listener may come to an understanding or misunderstanding of the semantic content of the utterance. Understanding is defined as

a two-step process, where the first step is to comprehend a general idea of an utterance whereas its second one – decode a communicative intention of an utterance (Cohen, 1967: 177–192).

Speaking about the complexity of the cognitive system and its role in perceived and generated speech, N. Zhinkin stresses that the expression of the speaker's communicative action acquires a certain meaning thanks to prosodic means. An experimental study of the speech of people with motor aphasia showed that the listener clearly perceives the general auditory tone of speech and associates and evaluates what he heard through commands localized in the right hemisphere of the brain, activated by pauses, rising and falling of the main tone, etc. (Zhinkin, 1969: 60).

Methodological Background of the research. We believe that intonation can be viewed as a structural component of speech generation as it is a complex unity of speech melody, sentence stress, tempo, rhythm and voice timbre which enables the speaker to express his thoughts, emotions and attitudes towards the contents of the utterance. These are perceptible qualities of intonation. The listener often deduces the gist of what is being said judging the pitch movement of speaker's voice. An example would be the word «yes» said with a different pitch movement. The word «yes» said with a firm tone of voice means «certainty», «resolute decision» while the same word uttered with a rising pitch movement means «doubt», «uncertainty». Thus, the two «intonation contours» involved would be different and the difference would be explained by saying that different combinations of pitch movement were being used (Laver, 1994: 40–87).

Examining the intonation system from the point of view of the peculiarities of sound signal perception, Cohen, Hart and Collier (Cohen, 1967: 179–186) conclude that in the most general form, mental representations of the suprasegmental level should be defined as a set of systematically determined prosodic features of speech, to which scientists refer to the frequency of the main tone, intensity and duration, which at the perceptual level correspond to the melodic, power and temporal components. Anyhow for our further consideration it is essential to envisage the issues embraced by the concept intonation. We have summed up a number of critical functions of intonation in the process of speech perception and generation:

– segmentation of the utterance into meaningful chunks;

– emphasis that makes one syllable more prominent than the other syllable, and therefore makes one word more prominent than the other word;

– patterning – stereotypic ways in which the pitch of the voice changes in the utterance.

Researching into the role of intonation in perception P. Monaham (Monaham, 2002: 14–19) considers the cognitive strategies of sound signal processing as a multidimensional, binary process, the main plans of which reflect: a) a continuous sequential processing of speech signal on different levels; b) forecasting of the content of an utterance; c) binary nature of speech signal processing that embraces discrete and continuous cognitive operations; d) the nature of decision-making can be both spontaneous and delayed. As we can see, the peculiarities of the speech signal processing are determined by the unity of its plans – content and acoustics.

So, here another problem emerges: to determine the units in which prosodic features are actualized. This issue is disputable in phonetics as the intonation system is defined as a hierarchy enabling the actualization of prosodic features. The syllable is widely recognized to be the smallest intonation unit. It has no meaning of its own, but it is significant for constituting hierarchal higher intonation units. Each syllable bears a definite amount of loudness. Pitch movements are inseparably connected with loudness. The syllable performs a constituting function, as it structures hieratically higher units of speech. Next unit in the system of prosodic units is a rhythmic, or accentual unit. It is either one stressed syllable or a stressed syllable with a number of unstressed ones grouped around it (Crystal, 1969; Ladd, 2001). Besides a definite accentual (rhythmic) pattern, the rhythmic group is characterized by a pitch pattern (or tonal contour) and duration pattern (temporal structure). These prosodic characteristics make it possible to perceive the rhythmic unit as an actual discrete unit of prosody. The rhythmic unit may be singled out of an utterance also due to the meanings expressed by its prosodic features. According to D. Bolinger these may be the meanings of assertiveness, separateness, newness (Bolinger, 1989: 100).

Results. The assays of our experimental research into perceptional clues of emotional speech show that the intonation group can be defined as a phonetic unity, which expresses asemantic entity in the process of speaking (and thinking) and which may consist either of one rhythmic group or of a number of such groups defined as a meaningful and structural

element of speech. Structurally the intonation group has some obligatory formal characteristics. These are the nuclear stress, on the semantically most important word and the terminal tone (i.e. pitch variations on the nucleus and the tail if any). The boundaries between intonation groups are marked by tonal junctures and pauses. All these features shape the intonation group, delimit one intonation group from another and show its relative semantic importance (Laver, 1994: 50–56). The structure of the intonation group varies depending on the number of syllables and rhythmic units in it (Table 1). Minimally, an intonation group consists of one (stressed) syllable – the nucleus. Maximally, it contains the pre-head, the head, the nucleus and the tail. The functional role of some of these elements is indisputable. The most conspicuous is the functional role of the **nucleus**, which has a perceptible change in its pitch. The pitch of this word may either fall or rise or change its movement first in one direction, then into another.

According to the results of the auditory experiment, pitch is clearly perceived by the listeners in terms of its directions and rate in the terminal zone and pre-terminal part of each of its intonation groups. The pitch level of the whole utterance (or intonation group) is determined by the pitch of its highest-pitched syllable. It shows the degree of semantic importance the speaker attaches to the utterance (or intonation group) in comparison with any other utterance (or intonation group), and also the speaker's attitude and emotions.

Parenthetical phrases and other semantically less important intonation groups of an utterance are characterized by a lower pitch level than the neighboring intonation groups.

E.g. The ˈpractical ˈphonetics eˌxam, ⩔ as ˈfar as I reˌmember, ⩔ was ˈone of the ˈmost ˌdifficult ⩔ in my acaˈdemic exˈperience.

The number of linguistically relevant pitch levels in English has not been definitely established yet. However, the assays of our experiment prove that in unemphatic speech listeners distinguish 3 pitch levels**:** low, mid and high. These levels are relative and are produced on different registers depending on the individual peculiarities of the voice. Besides low, mid and high levels, in some emotionally charged situations the recipients perceive the emphatic or emotional pitch levels that usually label strong emotions, such as happiness, anger or elation.

Table 1

E.g. *I am* ˈhappy to ˈpass my ˈpractical ˈphonetics eˌxam at ˌlast.

Pre-head	Head	Nucleus	Tail
I am	ˈhappy to ˈpass my ˈpractical ˈphonetics	eˌxam	at ˌlast

It is essential to point out that pitch range of an utterance, defined as the interval between its highest-pitched syllable and its lowest-pitched syllable, contributes to decoding the sincerity of emotional discourse. In the process of communication, the speaker changes his voice range to express different emotions, attitudes, connotations. For example, *«Very good»* pronounced with a narrow range sounds less emphatic and sincere. On the contrary, the same utterance pronounced with side range makes it sound sincere and enthusiastic.

During the experiment it has been established that terminal tones are clearly decoded by the listeners and guide their comprehension of sentence overall structure and implicit meaning. Thus, the meanings of the falling tone are distinctly interpreted as definiteness, completeness, finality, certainty. The meanings of the rising tone axe those of indefiniteness, incompleteness, non-finality, uncertainty. The falling-rising tone carries the meaning of reservation, implication or contrast.

Another perception clue has turned out to be significant pitch modifications in the head of the intonation group that make up one melodic shape, one part of the pitch contour of the utterance. It acts as a unit independent of the nucleus. The pitch variations in the head enable the recipients to decode relations between constituent units – rhythmic groups and interpret modal-stylistic meanings of an utterance. Thus, gradually descending head or ascending one sound unemotional, while sliding or scandent heads convey emotional shades.

E.g. It's the \only sensible \thing to ˌdo (unemotional).
It's the only sensible thing to ˌdo (emotional).
It's the only sensible thing to \do (emotional).
It's the only \sensible \thing to ˌdo (unemotional).

The pre-head is normally pronounced on the low or mid pitch level. If it is pronounced on a pitch somewhat higher than the normal pitch' (High Irregular Pre-head) or somewhat lower (Low Irregular Pre-head) the utterance acquires emphasis and emotional connotations.

E.g. ˉHe \can't have \possibly \meant it. (joy)
_But it is in\credible. (surprise)

The functional analysis of English prosody in general and speech melody in particular shows that the leading role in differentiating communicative types of utterances belongs to the terminal tone. That is why the communicative-distinctive function of speech melody is widely recognized as a purely linguistic function – a distinctive function proper.

A wide scope of the distinctive function of intonation includes also the modal-stylistic (or attitudinal) function. With this broad concept of the distinctive function in view we can state that the pre-head, the head and the terminal tone are functionally relevant elements of the utterance. Therefore, differentiation of melodic contours (tunes) of utterances must undoubtedly take into account the pitch characteristics of their elements (the pre-head, head (scale) and the terminal tone), each of which forms a separate subsystem of utterance prosody.

It is essential to interpret functional load of intonation clues with reference to the utterance as the basic communicative unit. The prosody of an utterance (intonation) carries independent meanings of its own, regardless of the words and the grammatical structure of the utterance. The inherent meanings of prosody which are of a general character (such as definiteness/uncertainty, assertiveness/reservations, separateness/connectedness, etc.) are specified and concretized when interacting with the grammatical and lexical meanings of the utterance. There may be cases of correlation and harmony between the inherent meanings of prosody and the meanings of words and grammatical structures as well as disbalance and disharmony.

E.g. It \may be ˌso (But I'm not quite sure) // It \may be so (I'm pretty sure)

The falling-rising tone is in harmony with the modal verb. Whereas in the second utterance the falling tone makes the statement sound categoric. Moreover, it gives greater precision and point to the meaning. It provides important information which is not contained in any of the other components of the utterance.

Moreover, prosody is the only language device that transforms words as appellative units (vocabulary items) into communicative units – utterances. In written speech prosodic features are to some extent indicated by punctuation marks.

E.g. \Fire! (exclamation); ˌFire! (command)

It is a command or an exclamation, depending on the situation in which it occurs: a question, a statement. Prosody is, therefore, the most common, the most elementary, the ever-present constitutive factor of the utterance. It forms all communicative types of utterances – statements, questions, imperatives, exclamations and modal (attitudinal) types: categoric statements, non-categoric, perfunctory statements, quizzical statements, certainty and uncertainty questions, insistent questions, etc.

Intonation clues are believed to be paramount to decipher modal meaning of an utterance. Various modal meanings can also be expressed and differentiated by lexical and grammatical means, such as modal words as «sure», «undoubtful», «definitely», «perhaps», «may be» «probably» and modal verbs «may», «might» and so on. Usually, the speaker's attitude corresponds to the contents of the words

he chooses. But utterance prosody may disagree with word content and is, then, the crucial factor in determining the modal meaning of the utterance.

E.g. *He \definitely ˌpromised // He \definitely ˌpromised.*

In the first case the melodic contour agrees with the word content and the grammatical structure, whereas in the second case it does not. So, the first utterance sounds definite and categoric. The second utterance sounds indefinite and non-categoric.

Conclusions. The results of the experimental research have proven that the intonation group can be viewed as a structural and meaningful entity of speech perception and recognition. The structural elements of the intonation group are interrelated to shape a sound representation of linguistic, cultural and emotional expertise of the speaker. The system of interrelated intonation clues performs a number of functions in the process of perception and generation of speech, such as: distinctive, constitutive, delimitative and emphatic. prosody is to provide a basis for the hearer to identify the communicative and modal type of an utterance, its semantic and syntactical structure in the framework of the communicative situation. Following this logics, acoustic clues provide a basis for the hearer to identify the communicative and modal type of an utterance, its semantic and syntactical structure in the framework of the communicative situation. All the functions of intonation clues are fulfilled simultaneously and cannot be separated one from another. They show that utterance prosody is linguistically significant and meaningful.

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